

- Coras medicinalis* Hentz, Chamberlin and Ivie 1944: 129.  
*Coras medicinalis* Hentz, Roewer, 1944: 20.  
*Tegenaria nemorensis* Walckenaer, Roewer, 1944: 33.  
*Coras medicinalis* Hentz, Muma, 1946: 4-5, figs. 1-3, 21-24 (♂ ♀).  
*Coras medicinalis* Hentz, Kaston. 1948: 281-282, figs. 900-902, 1914-1915 (♂ ♀).  
 See Roewer, 1944: 20 for additional synonymy.

## LITERATURE CITED

- ABBOT, John T. *Drawings of the insects of Georgia, in America* 14: 116 plates. 1792. (MSS.)  
 BANKS, N. *Indiana caves and their fauna (arachnid section)*. Ann. Rep. Indiana Dept. Geol. and Nat. Res. 21: 202-205. 1896.  
 ———. *Arachnida from Baja California and other parts of Mexico*. Proc. California Acad. Sci. (Zool.), ser. 3, 1 (7): 205-308. 1898.  
 BRYANT, E. B. *New species of southern spiders*. Psyche 43(4): 1-79. 1935.  
 CHAMBERLIN, R. V., and IVIE, WILTON. *Miscellaneous new American spiders*. Bull. Univ. Utah 26(4): 1-79. 1935.  
 ———. *New spiders of the family Agelenidae from western North America*. Ann. Ent. Soc. Amer. 30(2): 211-241. 1937.  
 ———. *A hundred new species of American spiders*. Bull. Univ. Utah 32(13): 1-117. 1942.  
 ———. *Spiders of the Georgia region of North America*. Bull. Univ. Utah 35(9): 1-267. 1944.  
 CLERCK, C. *Aranei Suecici*: 1-154. Stockholm, 1757.  
 CROSBY, C. R. *Some arachnids from the Carlsbad Cave of New Mexico*. Proc. Ent. Soc. Washington 28(1): 1-5. 1926.  
 EXLINE, H. *New and little known species of Tegenaria (Agelenidae)*. Psyche 43(1): 21-25. 1936.  
 ———. *The Araneida of Washington: Agelenidae and Thaumiidae*. Univ. Washington Publ. Biol. 9(1): 1-44. 1938.  
 ———. *Tegenaria agrestis (Walckenaer), a European agelenid spider introduced into Washington State*. Ann. Ent. Soc. Amer. 44(3): 308-310. 1951.  
 FOX, I. *Notes on North American agelenid spiders*. Can. Ent. 69: 174-177. 1937.  
 HENTZ, N. M. *A notice concerning the spiders whose web is used in medicine*. Journ. Acad. Nat. Sci. Philadelphia 2: 53-55. 1821.  
 ———. *Descriptions and figures of the Araneides of the United States*. Boston Journ. Nat. Hist. 5: 443-478. 1847.  
 KASTON, B. J. *The spiders of Connecticut*. State of Connecticut Public Document 47. State Geol. and Nat. Hist. Surv. Bull. 70: 1-874. 1948.  
 MUMA, M. H. *New and interesting spiders from Maryland*. Proc. Biol. Soc. Washington 58: 91-104. 1945.  
 ———. *North American Agelenidae of the genus Coras Simon*. Amer. Mus. Nov. 1329: 1-14. 1946.  
 PICKARD-CAMBRIDGE, F. O. *Araneida*. In Biologia Centrali-Americana 2: 313-424. 1902.  
 PICKARD-CAMBRIDGE, O. *On some new and little-known spiders from the Arctic regions*. Ann. Mag. Nat. Hist., ser. 4, 20: 273-285. 1877.  
 ROEWER, C. F. *Katalog der Araneae* 2: 1-160. Bremen, 1944.  
 WALCKENAER, C. A. *Faune Parisienne: Insectes* 2: 187-250 (spiders). Paris, 1802.  
 ———. *Histoire naturelle des insectes: Apteres* 2: 1-548. Paris, 1841.

ENTOMOLOGY.—*Johnsonaeapsylla audyi*, a new genus and new species of flea from North Borneo, with notes on the subfamily Leptopsyllinae (Siphonaptera).<sup>1</sup>

ROBERT TRAUB, Lt. Col., M.S.C., Army Medical Service Graduate School, Washington, D. C.

In connection with studies on the epidemiology of scrub typhus and leptospirosis, a joint U. S. Army-British Colonial Office Medical Research Team operated in North Borneo in July and August 1951. During the course of these investigations, fleas, mites, and other ectoparasites were collected from small mammals, particularly on Mount Kinabalu. Among the material represented in the valuable collections is the unusual flea herein described as a new genus and

new species of the family Ceratophyllidae, subfamily Leptopsyllinae. Fleas of this subfamily are frequently true parasites of *Rattus*, as well as of *Mus* and other mice, and hence are of potential medical significance.

A discussion of the subfamily Leptopsyllinae is included in this paper because of recorded differences of opinion as to the systematic position of this important group of fleas and because the new genus makes necessary a reevaluation of the diagnostic characters of the subfamily. This genus also indicates relationship between the Leptopsyllinae and the Amphipsyllinae.

<sup>1</sup> Published under the auspices of the Surgeon General, Department of the Army, who does not necessarily assume responsibility for the professional opinions expressed by the author.

## Family CERATOPHYLLIDAE

## Subfamily LEPTOPSYLLINAE

*Johnsonaeipsylla*, n. gen.

The only leptopsylline flea which lacks a genal etenidium or which has five pairs of lateral plantar bristles. Agrees with *Paratenopsyllus* Wagner, 1938, and *Peromyscopsylla* I. Fox, 1939, in the absence of a dark tuber above upper margin of the antennal groove in vicinity of the characteristic pale ring (Fig. 1, *RG.*). Agrees with *Paratenopsyllus* Wagner, 1938, in that the anterior portion of the head is normal in shape, not conical as in other leptopsyllines. Caput fractum. Eye distinct but somewhat reduced. Preantennal region with three rows of bristles, some of first row submarginal and somewhat spiniform. Frontal tubercle distinct. Postantennal area with three rows of bristles. Antennal segment 2 with bristles short; in male, not reaching beyond proximal fourth of club. Antennal groove not extending onto propleuron. Labial palpi much shorter than forecoxae. First vinculum or link-plate (*VC.1*) received in distinct sinus of prosternosome. Pronotal comb consisting of narrow spines. Pronotum with one row of long bristles. Some of dorsolateral bristles of protibiae short and straight, forming a reduced comb; these bristles on mesotibiae and metatibiae smaller, so that comb is vestigial (unlike other fleas in subfamily). Procoxae with many lateral bristles scattered over length of segment; other coxae with very few bristles and these on anteroventral margin. Profemora with very few lateral and mesal bristles. Mesosternum (Fig. 7, *MST.*) apparently enlarged so that metasternum appears as if divided into dorsal and ventral regions by an oblique sclerotization. Lateral metanotal area (*L.M.*) distinct. Pleural region of metasternosome fitting into well-sclerotized socket, the pleural arch (*PLA.*). Metanotum and some of typical abdominal terga with apical spinelets. Unmodified terga usually with two rows of bristles, but first row reduced, or absent on some. Spiracles subovate. Male with three antepygial bristles. Eighth tergum fairly well developed, extending as far caudad as middle of immovable clasper. Eighth sternum (Fig. 4, *SS.*) relatively large and unmodified. Digitoid (*F.*) with stout bristles but no spiniforms. Apical appendage of aedeagus (*AP.A.*) very well developed. Sclerotized inner tube (Fig. 9, *S.I.T.*) oblique and relatively unarmed, with distinct

apicomedian sclerite (*A.M.S.*). Crochets (*CR.*) very large and conspicuous. Distal arm of ninth sternum narrow and sinuate; without spiniforms.

The female of this genus is unknown.

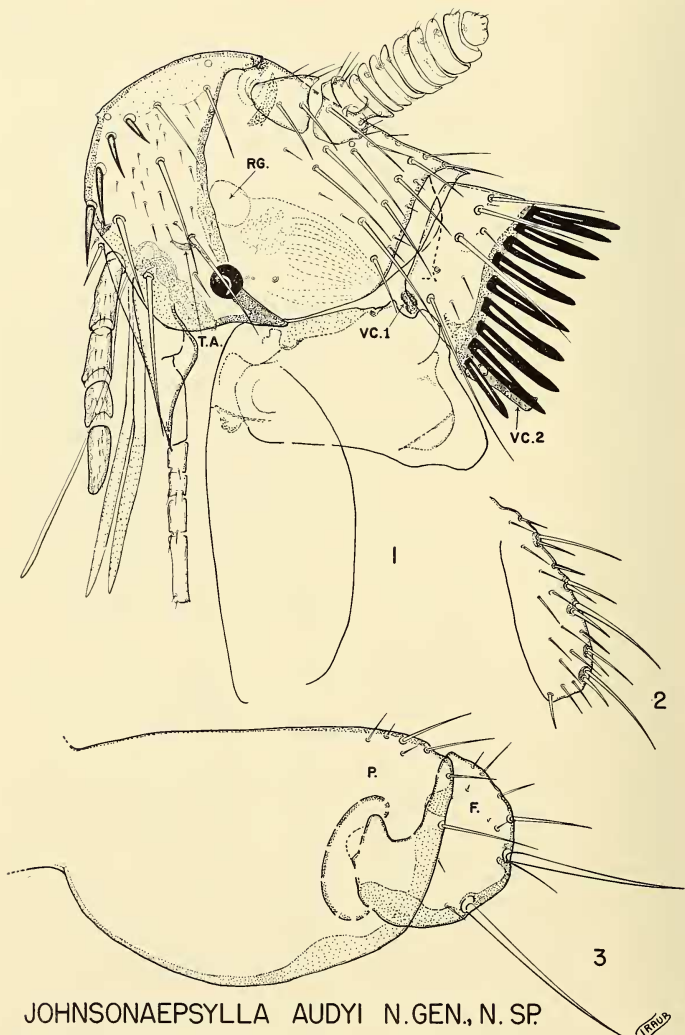
Genotype: *Johnsonaeipsylla audyi*, n.sp.

The genus is named for Miss Phyllis Johnson, of the Department of Entomology, Army Medical Service Graduate School, Walter Reed Army Medical Center, Washington, D. C., one of the most promising students of medical entomology and to whom I am much indebted.

*Johnsonaeipsylla audyi*, n. sp.

*Types*.—Holotype male *ex Hylomys suillus* Muller, a small spineless hedgehog (Insectivora, Erinaceidae); North Borneo, Mount Kinabalu, elevation 5,000 feet, Tenompak; July 16, 1951; collected by R. Traub. Two paratype males with same data but from two other *Hylomys suillus*. A fourth paratype male, *ibid.*, but at Lumu Lumu, elevation 6,300 feet, in the cloud forest; July 21, 1951. Holotype deposited in the collections of the United States National Museum. Paratypes deposited in the Chicago Natural History Museum, the British Museum (Tring), and the author's collection.

*Head* (Fig. 1).—Preantennal region with bristles as follows: First row of six, ventral four of which are stout and more or less spiniform, particularly the upper two at level of frontal tubercle; second row of two large bristles, ventralmost submarginal; third row of two long bristles, uppermost at or somewhat above level of eye. Anterior arm of tentorium (*T.A.*) visible on each side as a rodlike structure anterior to eye. Eye subovate, small. Genal process subacute. Maxillary lobe with anterior wing weakly sclerotized but distinct, arising anterior to base of maxillary palpi. The more heavily sclerotized portion (that area usually depicted in drawings of maxillary lobes of most fleas) originating definitely posterior to these palpi. Apex of maxillary lobe extending distad of base of fourth segment of maxillary palpi. Labial palpi 5-segmented, extending three-fourths length of forecoxae. Scape of antenna with about three short dorsomarginal subapical bristles. Second antennal segment with apical bristles short, not reaching beyond apex of third segment of club. Postantennal region with rows of bristles arranged 3-4 (5)-6 per side, ventralmost of last row displaced to ventrocaudal angle; at



JOHNSONAEPSYLLA AUDYI N.GEN., N. SP.

FIG. 1.—Head and prothorax, male. FIG. 2—Protibia. FIG. 3.—Immovable process of clasper and digitoid.

times with an additional dorsomarginal bristle at base of flange; intercalaries displaced caudad along margin of flange. First vinculum or link plate (*VC.1.*) somewhat irregular in shape, at times subpyriform.

*Thorax.*—Pronotum with a row of four or five long bristles; small intercalaries displaced caudad; with a comb of about 10 or 11 spines on a side; the spines straight or slightly concave. Second vinculum (*VC.2.*) almost completely concealed by lower spines of pronotal comb; very broad at base, apex upcurved where it hooks onto mesepisternum. Mesonotum (Fig. 7, *MSN.*) with about four rows of bristles, first row of shortest bristles, those of last row longest, about four in number; ventralmost arising above midpoint of notum. Mesonotal flange on each side with a subdorsal pseudoseta (*PS.S.*). Mesopleuron with a total of about 11 or 12 bristles, of which two to four appear to be on mesepisternum (*MPS.*), the remainder on mesepimere (*MPM.*). Metanotum, together with its flange, slightly longer than mesonotum; with three rows of bristles, none extending ventrad to midline. Metanotal flange with a dorso-apical tooth. Lateral metanotal area (*LM.*) almost twice as long as broad; with two bristles, dorsomarginal the longer. Metepisternum (*MTS.*) with one long bristle in posterodorsal region. Metepimere (*MTM.*) with about seven long bristles arranged 3-3-1.

*Legs.*—Profemur with about four lateral non-marginal bristles, mesofemur and metafemur with about three or four subapical, lateral bristles; none on apicoventral flange. Legs long and narrow, e.g., metatarsal segment one almost six times as long as broad. Protibia (Fig. 2) with five pairs of dorsomarginal bristles and with a single stout bristle between dorsalmost and second pairs and another such bristle between third and fourth pairs. Mesotibia and metatibia the same but three of these pairs much more conspicuous and of longer bristles than the others; also differing in that there are two single stout bristles between third and fourth pairs. None of tarsal bristles reaching beyond apex of following segment. Measurements (in microns) of tibiae and segments of tarsi (petiolate base deleted) of holotype:

Leg	Tibia	Tarsal Segments				
		I	II	III	IV	V
Pro-	225	95	90	80	55	120
Meso-	340	190	145	100	60	125
Meta-	450	330	220	135	75	140

*Abdomen.*—First tergum (*1T.*) with two rows of bristles and one or two subdorsal spinelets. Basal sternum with one ventromarginal bristle on each side. Terga II to V with with one apical spinelet per side. Second terga with first row of bristles represented by three bristles, third and fourth terga with one or two such bristles; remaining unmodified terga with but one row of bristles; second row of bristles extending slightly below spiracle in each case. Typical sterna with two subdorsal bristles per side. Antepygial (antesensillar) bristles with middle bristle twice length of lower bristle; upper bristle slightly shorter than lower.

*Modified abdominal segments* (Fig. 4).—Eighth tergum (*8T.*) extending as far caudad as base of acetabulum and ventrad to upper portion of aedeagal apodeme; with a long apical bristle and two long median bristles, one of these below sensillum. Eighth sternum extending apicad only to about level proximad of midpoint of distal arm of ninth sternum; extending dorsad slightly above manubrium and therefore somewhat broader than long; with two subventral bristles.

Immovable process of clasper (*P.* and Fig. 3.) subovate, about two-thirds or three-fourths as broad as long; dorsal margin slightly convex; ventral margin evenly convex, caudal margin fairly straight. Process *P.* with two dorsomarginal subapical bristles and two or three much smaller bristles adjacent to antermost of these; caudal margin with a subapical bristle and a longer bristle well above midpoint, the last suggestive of characteristic bristle of so many leptosylline fleas and perhaps homologous with acetabular bristles of true ceratophyllid fleas. Movable finger or digitoid (*F.*) inserted relatively well proximad on *P.*; almost twice as long as broad, but basally recurved; anterior margin apically fairly straight; posterior margin convex. *F.* with two long bristles, one at midpoint and one at proximal third; caudal margin with three or four much smaller bristles above stout median bristle; then a few scattered hairs. Manubrium (*MB.*) long and narrow, apically somewhat upturned.

Ninth sternum with proximal arm (*P.A.9*) slightly longer than distal arm (*D.A.9*); relatively long and narrow, apically subacuminate, resembling slightly crooked finger. Distal arm of ninth sternum (*D.A.9* and Fig. 6.) also relatively long and narrow. Morphological ventral

margin markedly sinuate at apical third, the resulting convexity or lobe bearing four bristles, two of which are quite long; apical portion of arm above sinus distally ovate; with three sub-apical marginal thin bristles; with about five or six dorsomarginal bristles and three or four small scattered bristles. Aedeagal apodeme (*A.E.A.*) almost three times as long as portion of aedeagus distad of apodemal strut; over three times as long as broad; with a very well developed apical appendage (*A.P.A.*) and a well-developed proximal spur (Fig. 9, *P.S.*). Median dorsal lobe (*M.D.L.*) shallowly convex and turning straight ventrad; apically subtruncate and recurved; with a pair of long narrow apicomedian sclerites (*A.M.S.*) which are distally angled and expanded ventrad. Crochets (*CR.*) very large, longer than endchamber distad of apodemal strut; twice as long as broad, but with apical half conspicuously narrowed and upcurved, so that distal portion of crochet resembles geologist's hammer. Sclerotized inner tube (*S.I.T.*) fairly short, about twice as long as broad at maximum, oblique, with distinct sclerotized band of inner tube (*B.I.T.*) extending from its apex. Armature of inner tube (*A.I.T.*) represented as two dorsal spurs. Lateral lobes (*L.L.*) weakly sclerotized, extending from wall of aedeagal pouch to base of crochet at proximal portion of *S.I.T.* Wall of aedeagal pouch (*P.W.*) extending as a straight line from proximal spur; ventrally somewhat convex. Penis rods (*P.R.*) long but not fully coiled, paralleling apodemal rod of ninth sternum. Ventral intramural rod of endophallus (*I.R.*) heavily sclerotized. Sclerites of apodemal strut (*A.P.S.*) not clearly defined. Tenth segment conspicuous; sensillum (Fig. 4, *S.V.*) very flat; with about 17 pits per side. Dorsal lobe of proctiger (*D.A.L.* and Fig. 5) with four or five dorsomarginal and two ventromarginal bristles. Ventral lobe (*V.A.L.*) of proctiger with two subapical ventromarginal bristles, its dorsal margin weakly sclerotized.

The species is named for Dr. J. R. Audy, director of the Colonial Office Scrub Typhus Research Unit, Kuala Lumpur, Malaya, who has contributed much to our knowledge of arthropod-borne diseases. As a member of the U. S. Army Medical Research Units in Malaya and Borneo, 1948-1951, I am particularly indebted to him for his splendid cooperation throughout the course of our investigations.

#### DISCUSSION OF THE SUBFAMILY LEPTOPSYLLINAE

Fleas of the subfamily Leptopsyllinae are characteristic parasites of murid and ericetid rodents and of certain insectivores. As a group these fleas are widely distributed, indigenous forms being known from Europe; much of Asia, including the Middle East, Asiatic U.S.S.R., and China; Africa; North America; New Guinea; North Borneo and the Philippines.<sup>2</sup> Some confusion exists in the literature as to the systematic position of *Leptopsylla* Jordan and Rothschild, 1911, and its allies: *Peromyscopsylla* I. Fox, 1939, *Pectinoctenus* Wagner, 1929, *Paractenopsyllus* Wagner, 1938, and *Sigmactenus* Traub, 1950. According to the traditional emphasis upon presence of a genal comb and of a fracticipit head-capsule, these fleas belong to the Hystrichopsyllidae. More recent workers, studying independently, and to a certain extent utilizing different morphological characters, have stated that this complex belongs with the ceratophyllid fleas (3, 4, 6, 7). It is felt by these students that the presence or absence of genal spines or a fracticipit condition does not necessarily indicate fundamental relationship. For this reason Traub (6) restored the combless<sup>3</sup> *Catallagia* Rothschild, 1915, to proximity with the combed *Epitedia* Jordan, 1938, and *Neopsylla* Wagner, 1933 (a position intended by the authors), instead of leaving it in the "Dolichopsyllidae" where it had been placed among combless fleas which were otherwise very different morphologically (1, 2).

*Leptopsylla* and allies agree with the ceratophyllid fleas in the following characters (*partim*): (1) Metanotum with apical spines; (2) sensillum dorsally straight; (3) male with third aedeagal rod arising as a tendon from the ninth sternum; (4) male eighth tergum large, enclosing much or most of genitalia; (5) male eighth sternum correspondingly reduced, covering relatively little of genitalia; (6) aedeagal crochets typically very large, movable, articulated ventrally near base of sclerotized inner tube.

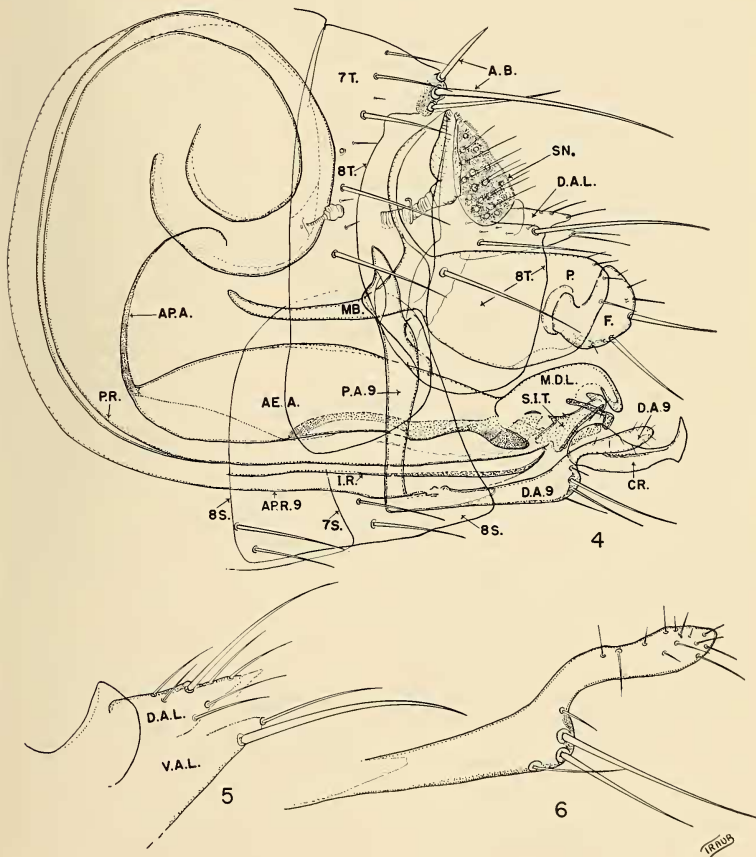
<sup>2</sup> *Acropsylla* Rothschild is now regarded by some workers as belonging in the tribe Mesopsyllini, subfamily Amphipsyllinae, a group of fleas related to the Leptopsyllinae, as shown below. *Acropsylla* occurs in India and Burma.

<sup>3</sup> The comb referred to is the genal etenidium and not the pronotal comb.



In contrast, the Hystrichopsyllidae may be characterized as follows: (1) Metanotum lacking apical spines; (2) sensilium more or less convex; (3) third aedeagal rod free, lying within end-chamber and not definitely arising as a tendon

from the ninth sternum; (4) male eighth tergum reduced, enclosing very little of genitalia; (5) male eighth sternum correspondingly enlarged, ensheathing much of genitalia; (6) crochets relatively small, not freely movable.



# JOHNSONAEPSYLLA AUDYI, N. GEN., N. SP.

FIG. 4.—Modified abdominal segments, male. FIG. 5.—Dorsal and ventral anal lobes. FIG. 6.—Distal arm of ninth sternum.

The Leptopsyllinae<sup>4</sup> prior to the discovery of *Johnsonaeapsylla*, n. gen., could be separated from true ceratophyllids thusly: (1) Genal comb present; (2) arch of endoskeleton visible as tentorial arm (Fig. 1, T.A.) in front of eye; (3) fracticipit; (4) antennal groove closed so that club of male antenna does not extend onto propleuron; (5) upper eye bristle not directly in front of eye; (6) some of head bristles stout and slightly curved, "spiniform"; (7) an ovate pale area or ring (Fig. 1, RD.) above ventral margin of antennal groove, near midpoint of groove; (8) male eighth tergum relatively smaller, not completely enclosing genitalia, extending caudad only to about middle of claspers and ventrad to middle of proximal arm of ninth sternum; (9) male eighth sternum correspondingly larger, extending dorsad to near base of clasper.

The following additional characters are typical of the Leptopsyllinae but may occur in true ceratophyllids: (10) Eye vestigial; (11) dorsolateral bristles of tibia forming a false comb; (12) crochets lacking a well-defined basal peglike or barrel-shaped sclerotization (if the peg is indicated it is ventromarginal); (13) a characteristic, long submedian marginal bristle on the immovable process (items 10 through 13 rarely occur in the Ceratophyllidae); (14) last segment of tarsi with four pairs of stout lateral plantar bristles and one pair of mesal plantar bristles.

*Johnsonaeapsylla*, n. gen., does not fit with this diagnosis of the subfamily in that it possesses a distinct (although somewhat reduced) eye, and lacks a genal comb, while the tibial false combs are so reduced (or undeveloped) as to be almost inapparent. *Johnsonaeapsylla* is also unique in possessing five lateral plantar bristles on the last tarsal segment of each leg.

It has been pointed out above that it is compatible with a concept of dynamic evolution for related fleas to differ regarding the presence of a genal comb. Similarly, many instances are known in which "blind" fleas very closely resemble species with well-developed eyes. In-

deed, reduction of eyes in fleas is frequently adaptive and correlated with parasitism of subterranean and/or nocturnal hosts (cf. *Pulex sinoculus* Traub, 1950, and *P. irritans* Linnaeus (6)). The presence of a genal etenidium is highly correlated with that of a reduced eye, while combless fleas usually have well-developed eyes, unless parasitizing a subterranean host (6, 8). *Jellisonia* Traub, 1944, is an example of a genus in which certain species have well-developed tibial "combs" and others have lost this structure on some legs (6, 9). *Stivalius* is another case where some forms have well-developed tibial "combs," while most species lack them (5). The number of lateral plantar bristles on the tarsi also varies in related genera.

For these reasons I feel that these differences between *Johnsonaeapsylla* and other leptopsyllines are secondary, not fundamental, and that *Johnsonaeapsylla* is merely an unspecialized if not somewhat primitive form. *Johnsonaeapsylla* agrees with the basic, essential characteristics of the leptopsyllines—those listed as numbers 2, 3, 4, 6, 7, 8, 9, and 13 above, while its genitalia are of a pattern typical of the subfamily. This new genus agrees with *Leptopsylla* and allies in two other characteristics typical (but not exclusive) of the group—viz, the maxillary lobe has a relatively well sclerotized wing which clearly arises anterior to base of the maxillary palpi, instead of being virtually invisible as in most fleas; the male proctiger has a distinct basal transparent collar or flange. The preantennal region is much more rounded in *Johnsonaeapsylla* than in typical leptopsyllines, where this region is subconical. However, *Paractenopsyllus* also lacks a conical frons.

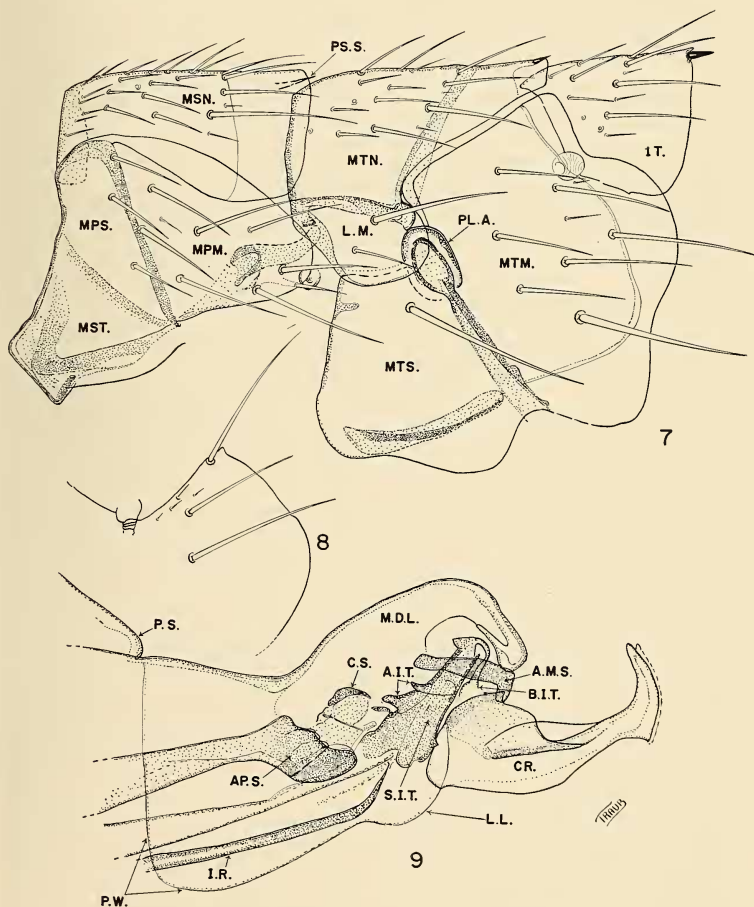
*Johnsonaeapsylla* indicates a close relationship with the Amphipsyllinae and in my opinion links the Leptopsyllinae with the Amphipsyllinae. Thus, fleas of the latter subfamily possess a visible tentorial arch, and may lack a genal etenidium. At times there is an indication of the interantennal suture and certain of these fleas possess the pale ring above the lower margin of the antennal groove. Some of these fleas have distinct eyes, while pre-antennal bristles modified so as to suggest spiniforms occur in *Ctenophyllus* Wagner, 1927. In the Amphipsyllinae, however, the male eighth sternum is well developed, large, and/or modified. The head is normally integrecipit, and if there is a suture indicated, it is not as apparent as in *Johnsonaeapsylla*, in

<sup>4</sup> Jordan, in Smart (4), treats *Leptopsylla* and allies in a separate family within an undeclared superfamily of ceratophyllid fleas. In litt., Dr. Jordan agrees that certain of the "families" in this chapter could equally well be considered "subfamilies" today, as I am doing in this paper. Our present state of knowledge of the higher classification of fleas is insufficient to categorically define superfamilies, families, and subfamilies, even though many authors now agree as to the various "groups" of fleas.

which it is well developed as in such typical leptosyllids as *Peromyscopsylla*. The peglike sclerotization of the crochet is usually well indicated in the Amphipsyllinae.

## SUMMARY

*Johnsonaepsylla audyi*, n. gen. and n. sp., collected ex *Hylomys* on Mount Kinabalu, North Borneo, is described and figured.



## JOHNSONAEPSYLLA AUDYI, N. GEN., N. SP.

FIG. 7.—Mesothorax and metathorax. FIG. 8.—Eighth tergum (*partim*), male. FIG. 9.—Apical portion of aedeagus.



The genus is unique in the subfamily Leptopsyllinae in that it lacks a genal ctenidium and it possesses a distinct eye and has five pairs of lateral plantar bristles on the last segment of the tarsi. While essentially an unspecialized leptopsylline flea, the new genus links this subfamily with the Amphipsyllinae.

#### ACKNOWLEDGMENTS

I am indebted to Dr. Karl Jordan, F. R. S., and Messrs. G. H. E. Hopkins and F. G. A. M. Smit, of the British Museum, for verification of the status of this interesting genus and for pertinent and valuable comments. Certain of the characteristics of the Leptopsyllinae listed herein are based in part upon observations by Jordan and Hopkins *in litt*.

#### REFERENCES

- (1) EWING, H. E. *A manual of external parasites*: 225 pp., 96 figs. 1929.
- (2) EWING, H. E., and FOX, I. *The fleas of North America*. U. S. Dept. Agr. Misc. Publ. 500: 1-142. 1943.
- (3) HOLLAND, G. P. *The Siphonaptera of Canada*. Dominion of Canada Dept. Agr. Techn. Bull. 70: 1-306, 350 figs. 1949.
- (4) JORDAN, K. Chapter on "Fleas" in Smart, J. *Insects of medical importance*: 211-245. British Museum, London, 1948.
- (5) JORDAN, K., and ROTHSCHILD, N. C. *On Pygiopsylla and the allied genera of Siphonaptera*. Ectoparasites 1: 231-265, 56 figs. 1922.
- (6) TRAUB, R. *Siphonaptera from Central America and Mexico*. Fieldiana: Zoology Memoirs 1: 1-127, 54 pls. 1950.
- (7) ———. *Notes on Indo-Malayan fleas, with descriptions of new species*. Proc. Ent. Soc. Washington 52(3): 109-143, 64 figs. 1950.
- (8) ———. *Hoogstraalia turdella, a new genus and species of flea from the Philippines*. Proc. Ent. Soc. Washington 53(2): 97-104, figs. 1-11. 1951.
- (9) TRAUB, R., and JOHNSON, P. T. *Atyphloceras tancitarum, and Jellisonia bonia, new species of fleas from Mexico*. Amer. Mus. Nov. no. 1558: 1-19. figs. 1-24, 1952.

#### LIST OF ABBREVIATIONS

AE.A.	Aedeagal apodeme.
A.I.T.	Armature of inner tube of aedeagus.
A.M.S.	Apicomedian sclerites of aedeagus.
APA.	Apical appendage of aedeagus.
AP.S.	Sclerite of apodemal strut.
B.I.T.	Band of inner tube extending distad of apex of sclerotized inner tube.
CR.	Crochet of aedeagus.
D.A.L.	Dorsal anal lobe.
D.A.9	Distal arm of ninth sternum.
F.	Digitoid or movable finger.
I.R.	Ventral intramural rod of endophallus.
L.M.	Lateral metanotal area.
MB.	Manubrium
M.D.L.	Median dorsal lobe.
MPM.	Mesepimere
MSN.	Mesonotum
MPS.	Mesepisternum
MTM.	Metepimere
MST.	Mesosternum
MTS.	Metepisternum
P.	Immovable process of clasper.
P.A. 9	Proximal arm of ninth sternum.
PL.A.	Pleural arch of metathorax.
P.R.	Penis rods.
P.S.	Proximal spur of aedeagus.
P.S.S.	Pseudoseta
P.W.	Wall of aedeagal pouch.
RG.	Pale ring above ventral margin of antennal groove.
S.I.T.	Sclerotized inner tube.
SN.	Sensillum
T.A.	Anterior tentorial arm of endoskeleton.
V.A.L.	Ventral anal lobe.
VC. 1	First vinculum or link-plate.
VC. 2	Second vinculum or link-plate.
SS.	Eighth sternum.
1T.	First tergum.

#### MALACOLOGY.—Generic and subgeneric names in the molluscan class Scaphopoda.<sup>1</sup>

WILLIAM K. EMERSON,<sup>2</sup> Museum of Paleontology, University of California.  
(Communicated by Harald A. Rehder.)

The supraspecific categories of the molluscan class Scaphopoda have not received serious study for more than 50 years. In the light of present knowledge it is apparent that they are in need of taxonomic review. The purpose of this paper is to indicate the

nomenclatural units that are available for future taxonomic and phylogenetic work in the class.

The Scaphopoda, the smallest of the five classes of the phylum Mollusca, are divided into the families Dentaliidae and the Siphonodentaliidae.<sup>3</sup> The families are distin-

<sup>1</sup> Contribution no. 66 from the Allan Hancock Foundation, University of Southern California.

<sup>2</sup> Formerly of the Allan Hancock Foundation, University of Southern California.

<sup>3</sup> D. K. Greger, 1933, p. 373, described *Throtopella typa*, n. gen., n. sp., from the Devonian of